AI & the REAL-World energy turnaround
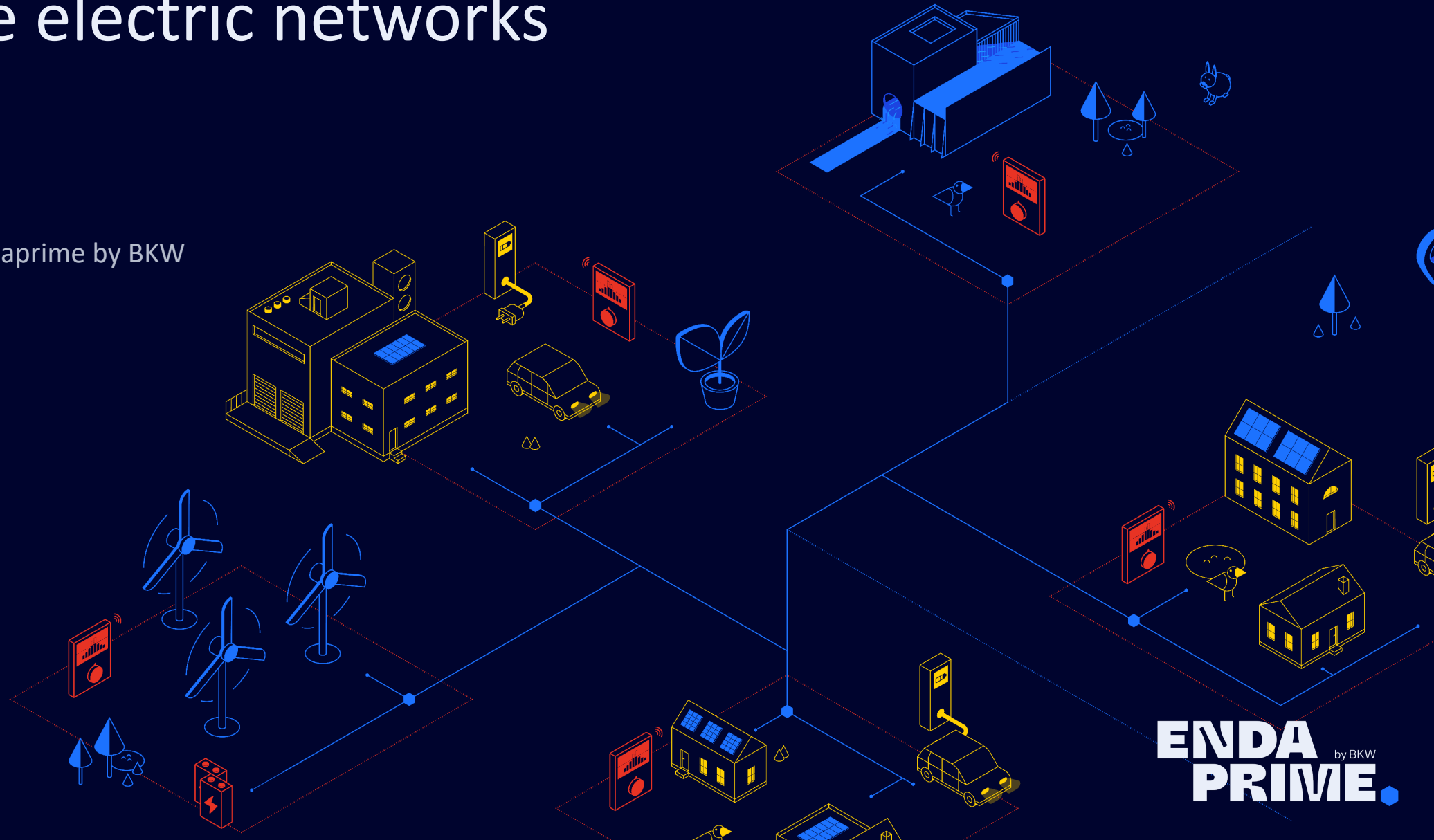## The future electric networks

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AMLD, EPFL
30. March 2022

ENDA PRIME
by BKW

The biggest change in humankind...

How did electric network worked until today?

BKW Network:

Up to 200 controllable Power Plants

~70 Intelligent Substations

Transmission Network (Swissgrid)

Distribution Network (BKW)

End Customers
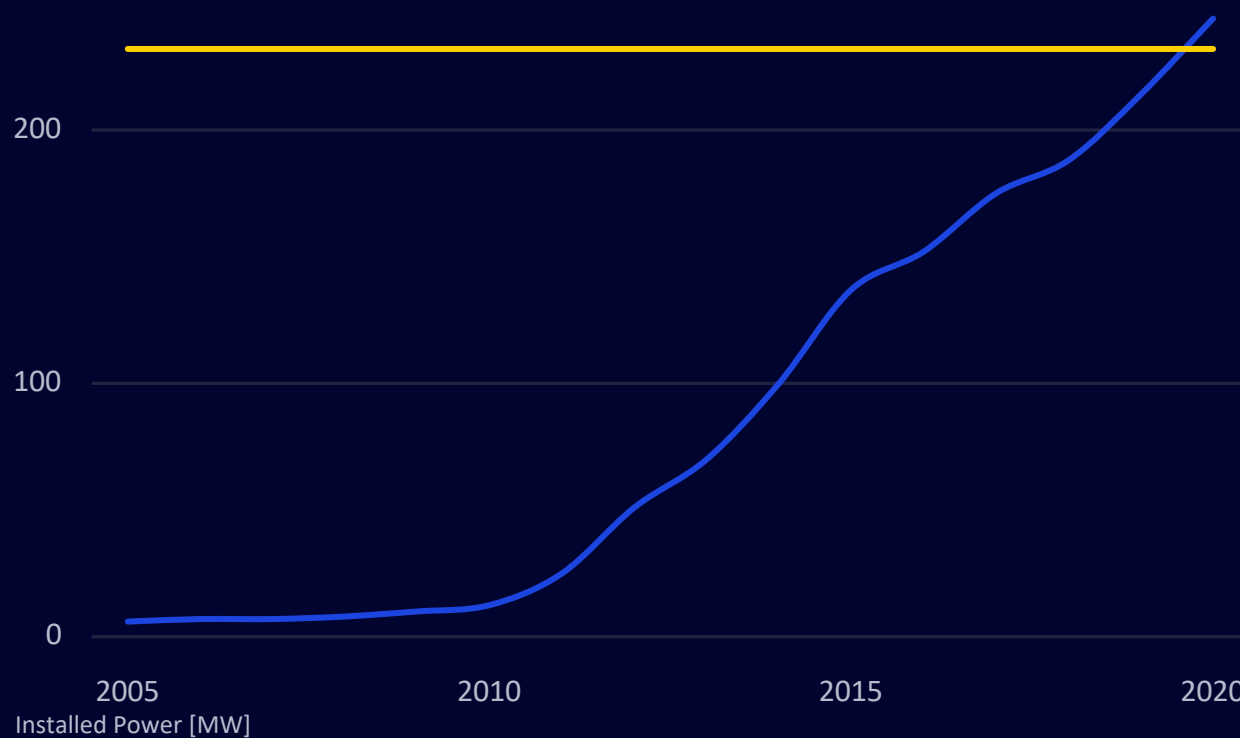
The Energy Transition is local & is here
More than 13'000 Energy-Investors in BKW Network

Installed Power of Solar Panels and Hydro Power Plants in BKW's Distribution Network
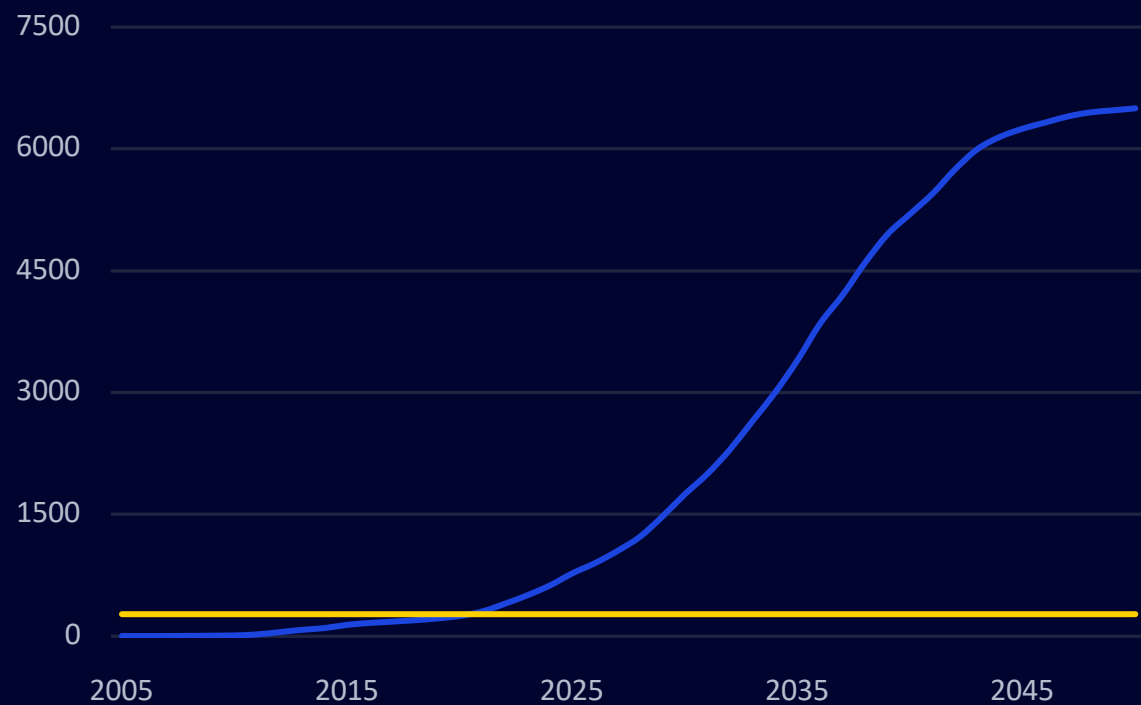
200

100

0

2005   2010   2015   2020
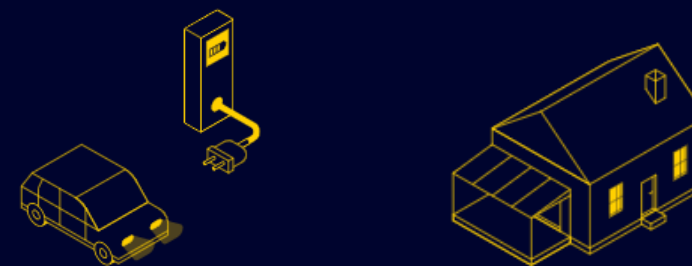
Installed Power [MW]

Source: BKW 2021

… and this is just the beggining
Perspective until 2050

Forecast of installed Power of Solar Panels and Hydro Power Plants in BKW's Distribution Network

7500
6000
4500
3000
1500
0

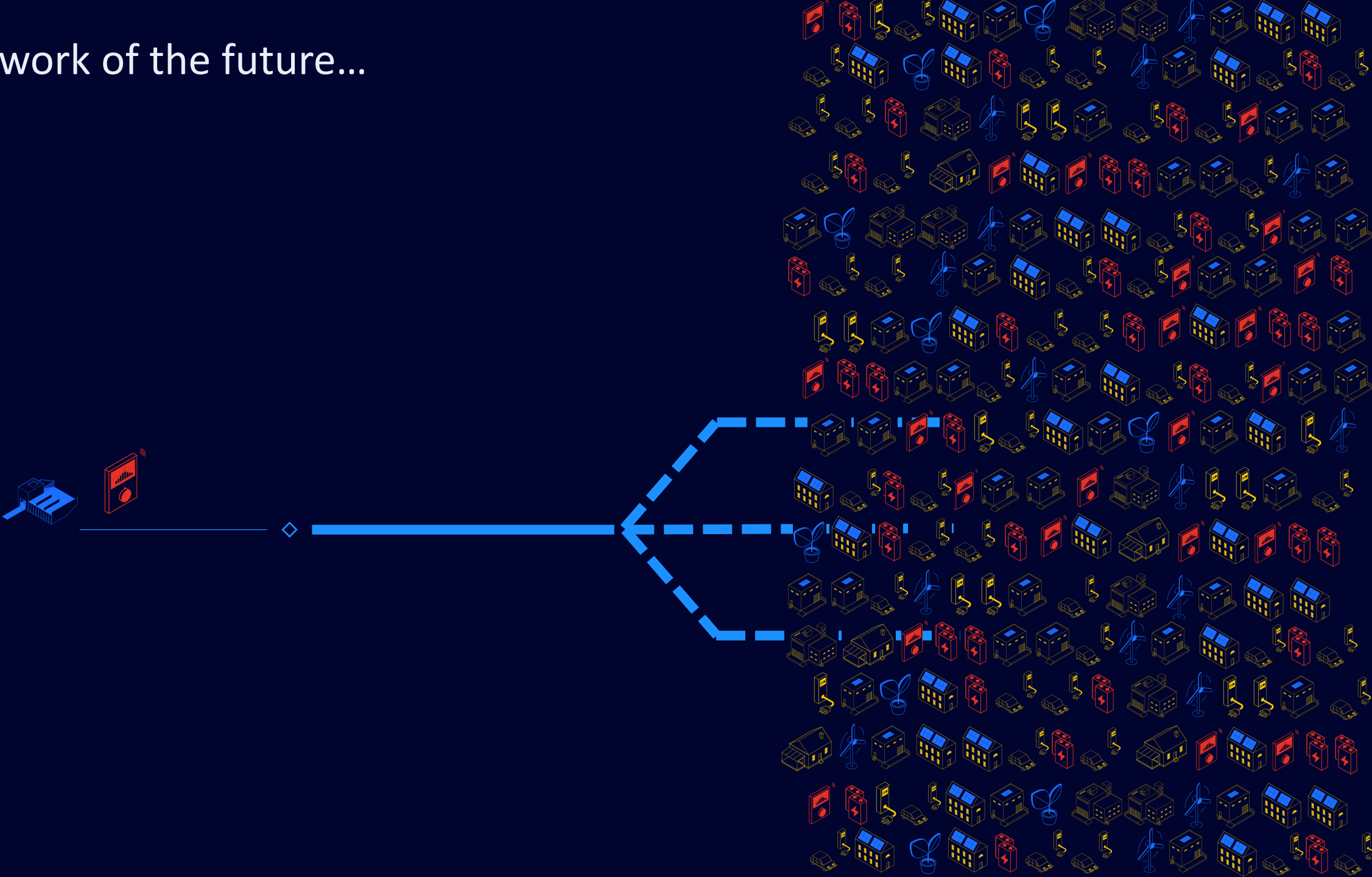2005   2015   2025   2035   2045

Expected Installed Power [MW]

Similar expectation for the electrification of transportation & heating systems

The network of the future…

What are the challenges for ML-Solutions in power grids?

00 **Unbundling**: Power grids (regulated) and energy markets (almost liberalized)

01 Reliability is the key in power grids (the simpler, the better)

02 Network Engineer's world (deterministic instead of probabilistic environments)

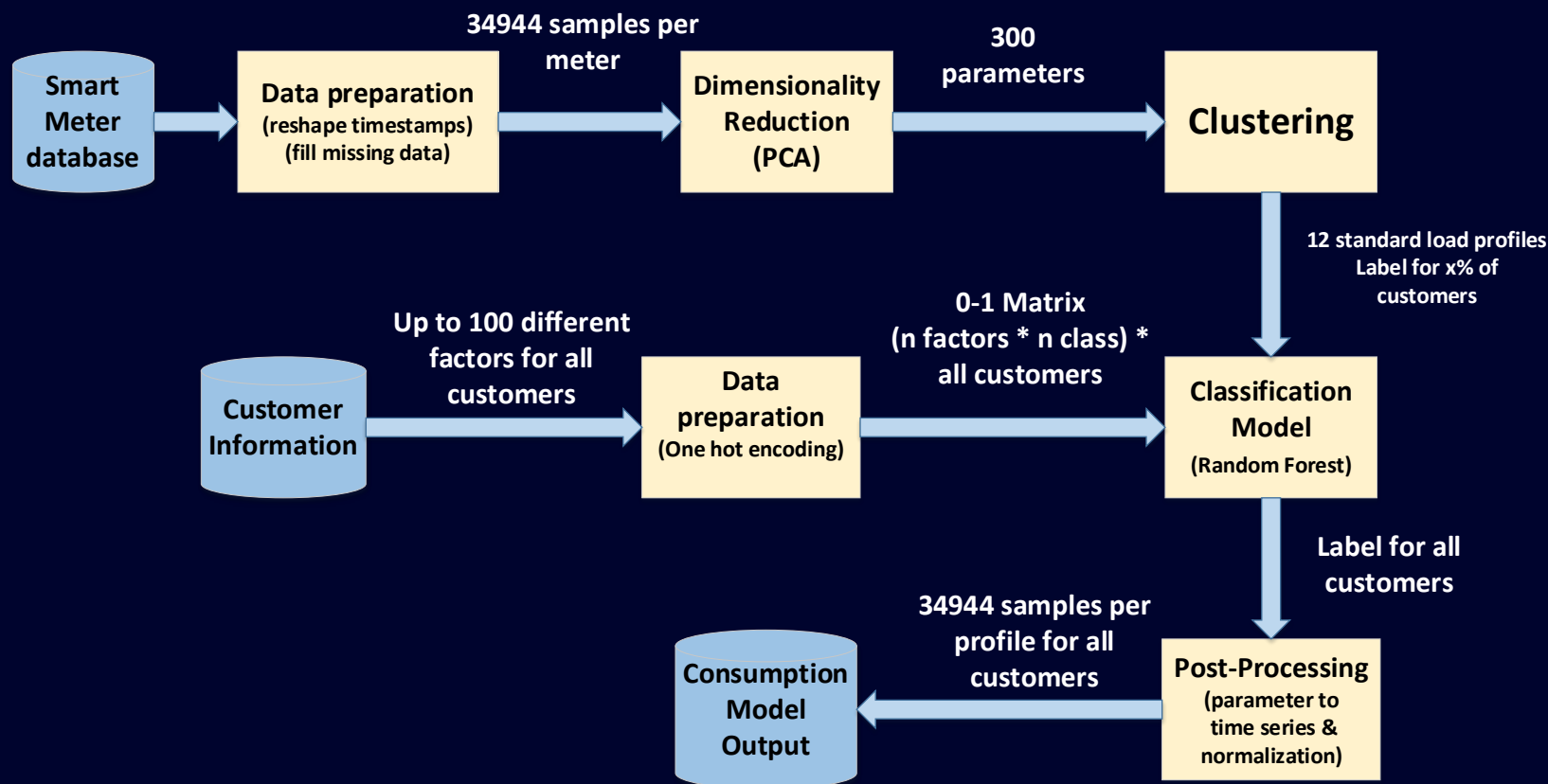03 Fear of black boxes (Engineers require to understand decisions)

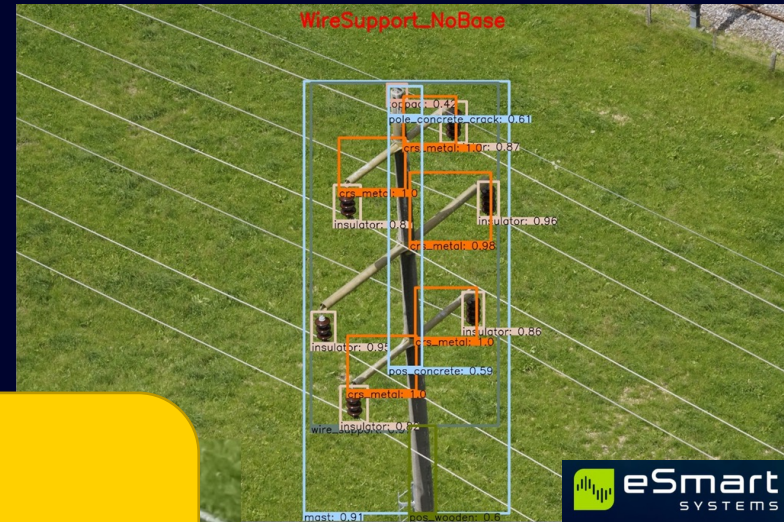04 Power and Energy are analyzed independently

Quick Wins for ML:
1. Generate more information for existing processes

- Example: If we have 10% of customers with measurement devices, could we build a model to simulate the customer behavior for the other 90% of customers?
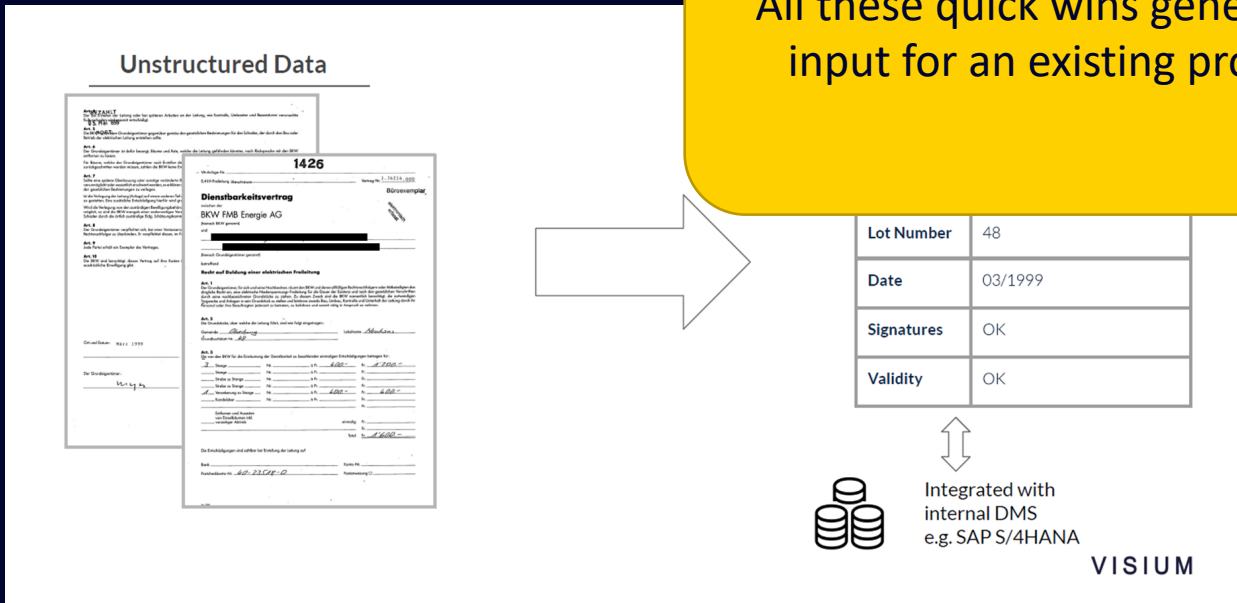
Quick Wins for ML:
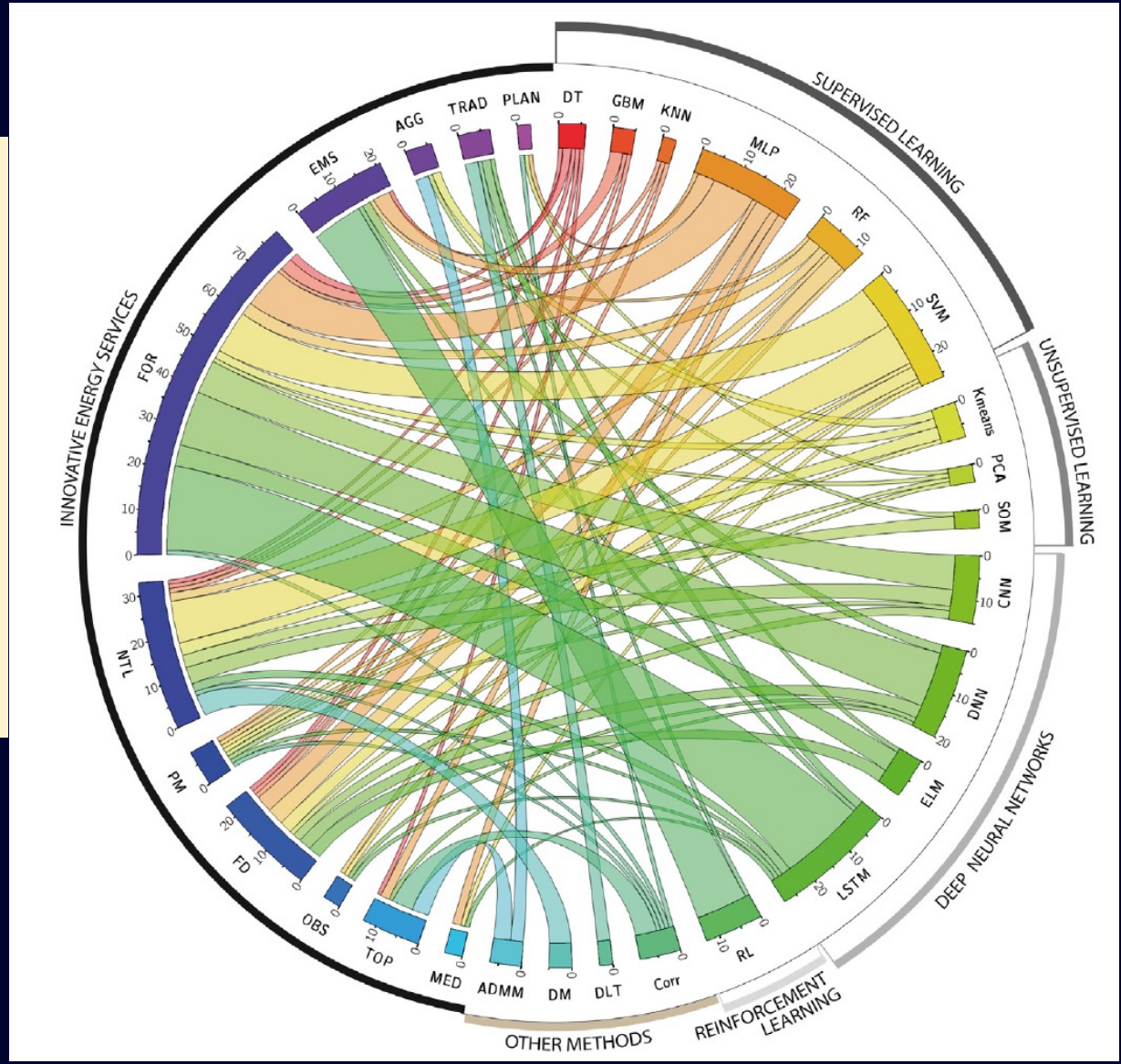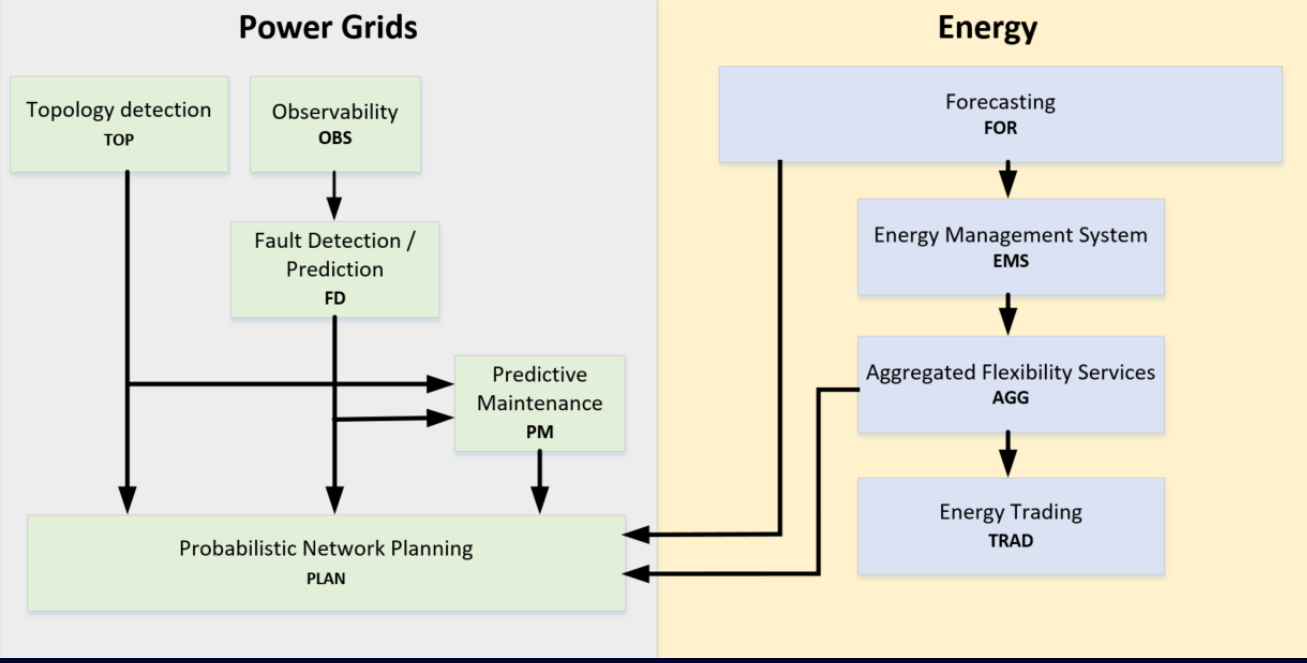# 2. Automatize processes

- Automatize simple tasks with AI

1. Identify defects on assets (picture recognition)

2. Classify existing contracts

All these quick wins generate an input for an existing process!

Unstructured Data

Lot Number	48
Date	03/1999
Signatures	OK
Validity	OK

Integrated with internal DMS e.g. SAP S/4HANA

VISIUM

Advanced Wins:
2. Automatize processes

Source: Artificial intelligence techniques for enabling Big Data services in distribution networks: A review, S. Barja et all

AI Disruptive Vision: Energy cells

An energy cell consists of the infrastructure for different forms of energy, in which the balance between production and consumption across all available forms of energy is managed by an energy cell intelligence in possible coordination with neighboring cells
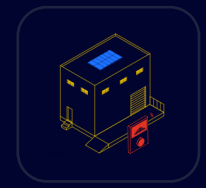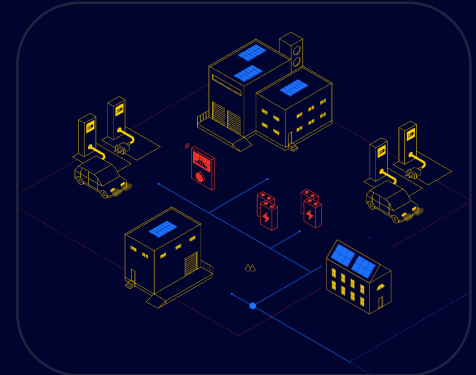
The cellular Energy System

01 Knows it's local state

02 Optimizes and controls locally

03 Supports the neighbour energy cells in order to optimize the local energy cell cluster

04 Coordinates with the Network Operator in order to ensure the reliability of the system

05 If everything fails, the energy cell runs on "survival mode"
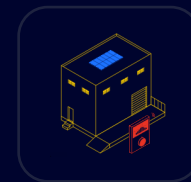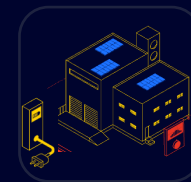
AI in the cellular Energy System

01 Advanced forecast models & state estimation
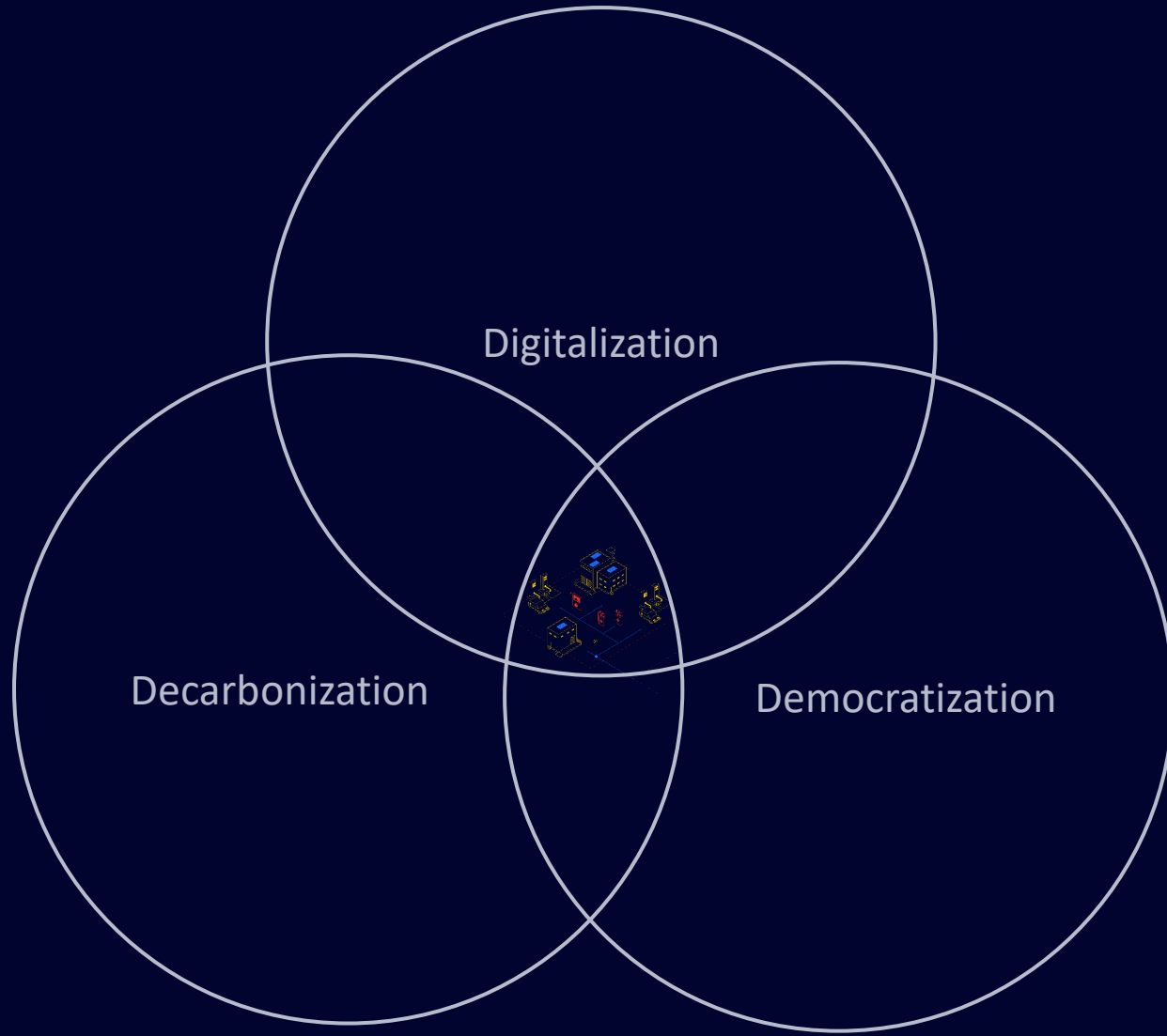
02 Local optimization

03 Dynamic Network Pricing

04 Agent-based P2P Market

05 **Proactive local network & energy planning**

Digitalization

Decarbonization

Democratization

What is the next move?

Questions?